US-PAT-NO: 6750157

DOCUMENT-IDENTIFIER: US 6750157 B1

TITLE: Nonvolatile memory cell with a nitridated oxide layer

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Detailed Description Text - DETX (7):
With respect to the nitridation process, the bottom silicon dioxide layer may be nitridated via a plasma containing nitrogen in order to mitigate charge leakage from the ONO stack to the channel. The **nitridation** process may be performed by applying an anodizing voltage during exposure of the silicon dioxide layer to a plasma containing nitrogen (N.sub.2) such as nitrous **oxide** (N.sub.2 O). The plasma may be administered at appropriate parameters (e.g., pressure, flow rate, temperature, duration, power) suitable to incorporate nitrogen into the bottom silicon dioxide layer in an amount sufficient to reduce charge leakage from the ONO stack. The bottom silicon dioxide layer may have a thickness from about 50 angstroms to about 200 angstroms. Because of the nitridation process, the bottom silicon dioxide layer may also have a thickness less than about 50 angstroms.

Detailed Description Text - DETX (15):
In accordance with one aspect of present invention, the bottom layer 112 of the stack 110 is a nitridated silicon dioxide layer, generally referred to as a nitridated tunneling oxide layer. More specifically, the nitridation process involves exposing the bottom silicon dioxide layer to a plasma containing

nitrogen such as N.sub.2 and N.sub.2 O in order to mitigate charge leakage from
such layer. The **nitridation** process incorporates nitrogen atoms onto at least
the silicon dioxide surface as well as into the bulk **oxide** below the surface.
Those skilled in the art will understand and appreciate various oxides (and
gate dielectrics) that can be utilized in accordance with an aspect of the
present invention. By way of illustration, various oxides that are commonly
used as gated dielectrics can be used to form the layer 112, including, for
example, SiO.sub.2, TiO.sub.2, Y.sub.2 O.sub.3, Gd.sub.2
O.sub.3, HfO.sub.2,
Ta.sub.2 O.sub.5, and the like.

Detailed Description Text - DETX (16):
In accordance with another aspect of the present invention, the intermediate
layer 114 of the stack 110 is hydrogen-annealed charge retention layer such as
a hydrogen-annealed silicon nitride layer. That is, the intermediate layer 114
has undergone a passivation process in order to mitigate the presence of
unwanted charge traps. In addition, the intermediate layer 114 can be a
silicon oxynitride layer (e.g., SiO.sub.x N.sub.y, where x and y are selected
to provide desired properties) or a silicon rich nitride layer (e.g., SiRN).

Detailed Description Text - DETX (18):
The top layer 116 of the stack 110 also is a dielectric layer. The layer
116 can be the same or a different silicon dioxide from the layer 112. For
example, the top dielectric layer 116 may include at least one of silicon
dioxide, **silicon oxynitride,** and silicon carbonitride. The top silicon dioxide
layer 116 mitigates both charge injection from the top P+ poly gate layer 118
as well as leakage of charge back up into the poly gate

structure at layer 118.

Detailed Description Text - DETX (51):
The bottom silicon dioxide layer portion of the ONO dielectric stack is formed over the p-type silicon substrate in accordance with known deposition or growth methods. Once the bottom silicon dioxide layer is substantially formed and prior to silicon nitride formation thereon, a nitridation process treatment is applied to the bottom silicon dioxide layer. The **nitridation** process may involve a plasma containing nitrogen, such as nitrous **oxide**. The bottom silicon dioxide layer is exposed to the plasma containing nitrogen for a time and at a flow rate and pressure sufficient to incorporate nitrogen atoms into at least the surface of the bottom silicon dioxide layer. Generally, the nitridation process as applied to the bottom silicon dioxide layer facilitates mitigating charge leakage, particularly when the thickness of the bottom silicon dioxide layer is less than 50 angstroms.

L Number	Hits	Search Text	DB	Time stamp
1	3934	ONO and (nitridation or ammonia or ammonium)	USPAT; US-PGPUB	2004/08/19 17:02
2	3823	(ONO and (nitridation or ammonia or ammonium)) and @ad<20030814	USPAT; US-PGPUB	2004/08/19 17:01
3	212	((ONO and (nitridation or ammonia or ammonium)) and @ad<20030814) and (silicon adj oxynitride)	USPAT; US-PGPUB	2004/08/19 17:04
4	31619	((nitridation or ammonium or ammonia) with oxide) and @ad<20030814	USPAT; US-PGPUB	2004/08/19 17:02
5	574	(((nitridation or ammonium or ammonia) with oxide) and @ad<20030814) and ONO	USPAT; US-PGPUB	2004/08/19 17:02
6	842	((nitridation) with oxide) and @ad<20030814	USPAT; US-PGPUB	2004/08/19 17:02
7	131	(((nitridation) with oxide) and @ad<20030814) and ONO	USPAT; US-PGPUB	2004/08/19 17:03
8	49	((((nitridation) with oxide) and @ad<20030814) and ONO) and (silicon adj oxynitride)	USPAT; US-PGPUB	2004/08/19 17:04